COLLABORATIVE/FRG RESEARCH: NANO-STRUCTURED MATERIALS OF COVALENTLY BONDED NETWORKS

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Objectives: The primary scientific objectives of this focussed research group (FRG) project is to: synthesize unusual C-based covalently-bonded amorphous and nano-crystalline materials with controlled nano-structures and properties in the focussed region of the ternary (C-B-N) system, develop/apply advanced techniques to characterize the nano-structures of these materials, and relate the scale of the nano-structure and connectivity of the amorphous network to the selected properties.

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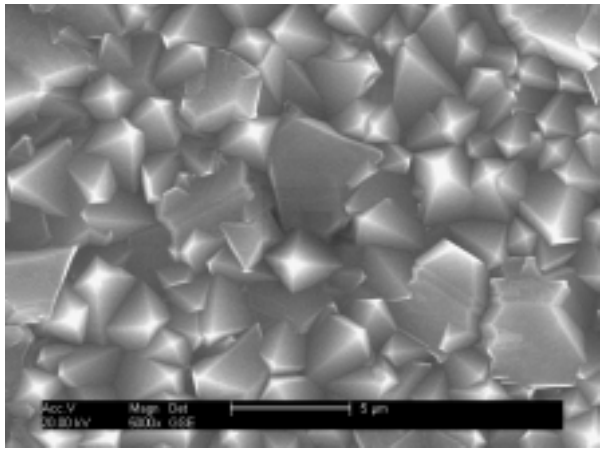
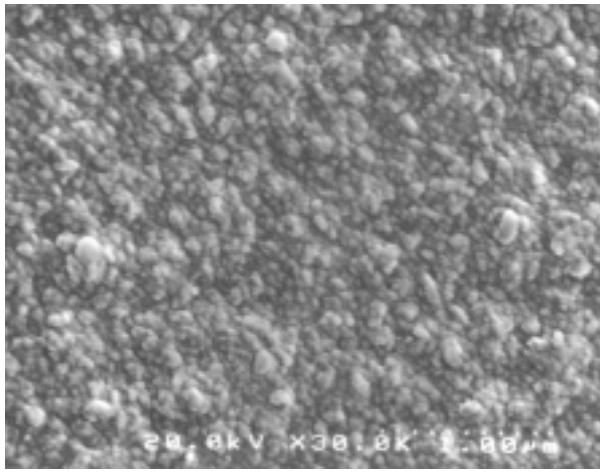
Results: Our research during this year was aimed at synthesizing nanocrystalline thin films of diamond by controlling the plasma deposition conditions. Depending on the plasma gas (hydrogen vs argon) it is possible to synthesize films with grain sizes from a fraction of a micrometer to as small as 60 nanometer as shown in figures



(A)



(B)

(A) Microcrystalline and (B) nanocrystalline diamond thin films deposited on Si wafers using microwave plasma enhanced CVD

Education and Outreach

Two graduate students and a research associate contributed to this project. One of the graduate students worked on the synthesis of the films by microwave plasma enhanced chemical vapor deposition technique (MPECVD) and another student worked on the characterization of these films using Raman Spectroscopy and X-ray diffraction techniques. These students also attended the Annual Meeting of the American Ceramic Society in Tennessee in May of 2003 to learn from other researchers in this field and broaden their professional outlook. An undergraduate student Jeff Mergy did his senior project on the synthesis of diamond thin films using MPECVD technique.